RESEARCH ARTICLE

Phytosociology of *Parthenium hysterophorus* and its possible management through some potential Bio-agents

Knox Jai[1*], Bhalerao SA[1] and Paul MS[2]

[1]*Department of Botany, Wilson College, University of Mumbai, Mumbai- 400 007.*

[2]*Department of Botany, St. John's College, Dr. B. R. Ambedkar University, Agra- 282 002.*

***Corresponding author e-mail**: jaiknox@rediffmail.com | Cell no.: +91-9920081094*

Manuscript details:

Received : 20 November, 2013
Final Received: 01 March, 2014
Finally accepted : 07 March, 2014

Date of publication (online):
30 March, 2014

ISSN: 2300-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Arvind Chavhan

Citation: Knox Jai, Bhalerao SA and Paul MS (2014) Phytosociology of P*arthenium hysterophorus* and its possible management through some potential Bio-agents, *International journal of Life Sciences,* 2 (1): 49-52.

ABSTRACT

Parthenium hysterophorus a noxious weed of today has its effect on human and animal health. This weed is known to cause asthama, bronchitis, dermatitis and hay fever in human and livestock. In a sample survey conducted in Bangalore, India it was recorded that 70% of the population suffers from allergic rhinitis due to pollen and 47% suffered from nasobranchial allergies. At present there is no effecteive treatment of dermatitis, other than exclusion of the weed but azathioprine therapy shows promising potential. Studies were undertaken to assess the phytosociology of *Parthenium hysterophorus* with other weeds growing in its vicinity and its control by some potent bio-agents. Studies were also undertaken to assess the chlorophyll content and percentage nitrogen of *Parthenium hysterophorus*. Maximum significant inhibition in chlorophyll content and percentage nitrogen was observed in shoot leacheates of *Cassia occidentalis* and *Calotropis procera* ,respectively.

Key Words : Allelopathy, Botanic agents ,Congress grass.

INTRODUCTION

Parthenium hysterophorus L. is commonly known as carrot weed in the Hindi speaking belt but known as Congress grass in other parts of India. The weed has spread throughout India after its noticeable occurrence in Pune (Maharashtra) in 1955. Now it has achieved the status of the countries "worst weed" owing to its allelopathic effects on agricultural crop production and harmful effects on people and animals. During the 1980s, *Parthenium* weed used to be considered a weed of fallow and wasteland but now it has become a weed of every crop and also into the forested land. The severity of the *Parthenium* weed problem has compelled researchers and people to from various action groups and societies to provide a forum for those in need and affected by *Parthenium* weed. The severe infestation of *Parthenium* weed has reduced the availability of palatable grasses to herbivores in Van Vihar National Park in Bhopal, Madhya Pradesh which has compelled the park authorities to undertake a large scale uprooting program. But the 3 year uprooting program, requiring a great deal of money, has not produced the desirable reduction in *Parthenium* weed density. *Parthenium* weed has become a problem in forest nurseries in Madhya Pradesh. In Karnataka, *Parthenium* weed along with *lantana*, *Chromolaena* and some other exotic weeds have threatened the palatable vegetation availability to elephants. This situation has compelled the Supreme court of India to instruct the states and central governments to constitute a task force to manage these weeds

for the survival of the elephants. *Parthenium* weed is not palatable to livestock due to its irritating odour, taste and presence of trichome hairs. However hungry cattle will eat the weed, but this will cause clinical signs such as those of salivation, anorexia, pruritus, alopecia and dermatitis. Gastro-intestinal irritation may result in diarrhea. In cattle, due to *Parthenium* weed contact, there may be some loss of hair and a marked depigmentation of the skin. Milk yield is reduced when hungry cows eat the *Parthenium* weed in pastures.

The objective of the present study was to determine: (i) the phytosociology of *Parthenium* with other plants and (ii) the biochemical analysis of *Parthenium* by the shoot leachates of *Cassia occidentalis, Calotropis procera, Withania somnifera* and *Datura stamonium.*

MATERIALS AND METHODS

Collection of data- Data on different parameters were collected at four different sites till five years. For plant census, quadrat of size $1m^2$ was laid at random. Likewise for basal area measurements, the circumference/diameter of the arborescent members was recorded in the field with the help of a measuring tape and foot rule.

Analysis of data- After collecting the field data, parameters like relative frequency, relative density, relative dominance, basal area and Importance value Index (IVI) of species were calculated by using the formulae given below (Oosting, 1958; Phillips, 1959; Hanson & Churchill, 1961). The major or dominant weed species were determined by computing SDR values (Sukarwo, 1991).

$$\text{Relative Frequency} = \frac{\text{Frequency of the species in stand X}}{\text{Sum of the Frequency of all the species in stand X}} \times 100$$

$$\text{Relative Density} = \frac{\text{Total no. of. Individual of a sp.}}{\text{Total no. of individual of all the sp.}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Total basal area of the sp. in the quadrates}}{\text{Total basal area of the sp. In all the quadrates}} \times 100$$

$$\text{Average Basal Area} = \sum \pi r^2 / N$$

$$\text{Total basal area of species (sq.mm/sqm)} = \text{Ave. Basal area} \times \frac{\text{No. of individual/ quadrates}}{\text{Size of quadrates}} \times 100$$

Importance value index (IVI)
=Rel. Freq. + Rel. Density+ Relative dominance

$$\text{Some dominance Ratio of a species} = \frac{\text{Rel. Freq. + Rel. Density+ Relative dominance}}{3}$$

Preparation of aqueous leachates

The upper parts of shoot tips were collected from the selected plants. 100 g of shoot tips were soaked in 500 ml of double distilled water each under aseptic conditions for 10 days and placed in conical flasks in a refrigerator at 8 °C. The aqueous leachates were filtered through three layers of muslin cloth/ cheese cloth to remove debris. The filtrate was then re-filtered through one layer of Whatman No.1 filter paper. Leachates 100% concentration were prepared with sterilized distilled water and used for bioassay.

Chlorophyll estimation

Chlorophyll content of *Parthenium hysterophorus* was estimated according to Arnon (1949). 40 mg (0.04 g) of *Parthenium* leaves were treated with 100% of shoot leachates of botanic agents for 72 h. After 72 h the treated *Parthenium* leaves were placed in black plastic bottles containing 10 ml of 80% acetone and then it was sealed with adhesive tape at its mouth so that acetone may not get evaporated and kept undisturbed in a refrigerator for 5-6 d at 8±1°C temperature. After 6 d optical density was recorded by spectrophotometer at different wavelength i.e. 480, 510,630, 645, 652, and 665 nm.

Nitrogen estimation

Nitrogen was estimated by following the method of Snell and Snell (1955). 100 mg (0.1 g) of *Parthenium* leaves were treated with 100% of shoot leachates of botanic agents for 72 h. Then the treated *Parthenium* leaves were placed in 50 ml conical flask and mixed with 2 ml of conc. H_2SO_4 and then it was heated on hot plate at 40°C. When volume reduces to half of the original volume, 1.5 ml of 30%H_2O_2 was added. Then the solution was heated gently at10-20°C till the clear extract w as obtained. The content was then transferred in 100 ml volumetric flask and the volume was made up to the mark with distilled water. After preparation of acid extract of plant material, the nitrogen was estimated as follows - 1.0 ml of prepared acid extract from plant material was taken in 50 ml volumetric flask. To this 10 drops of 10% NaOH and 10drops of 10% sodium silicate was added and the solution was diluted up to the mark. 1.0 ml of freshly prepared nesseler's reagent was added to the flask, the color intensity was measured by colorimeter after 15 min at transmittance of 420 nm using a reagent blank as reference. With the help of standard curve prepared with100 ppm NH_4Cl solution the amount of N_2 in the sample was found out.

Protein estimation The protein content in plant sample was calculated by multiplying percentage nitrogen content of plant sample by the factor of 6.25.
Percentage of Protein = % of Nitrogen × 6.25

Table-1: Phytosociological analysis of *Parthenium hysterophorus* and associate flora

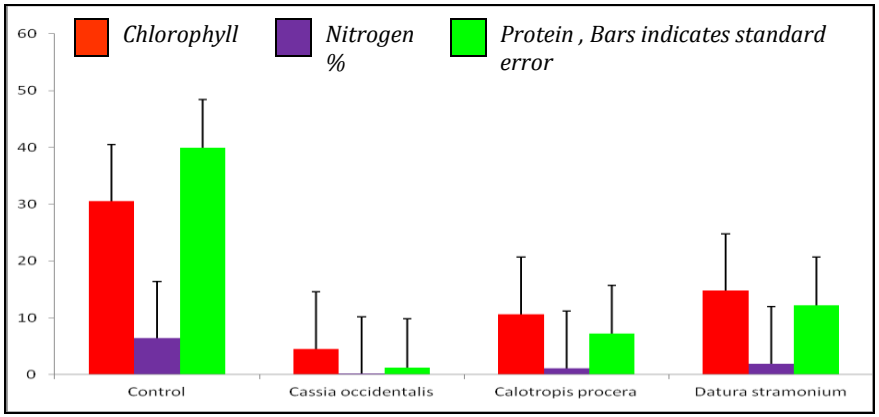
Site	Name Of Plant	Total No. of Individual Species	Total No. of quadrat in which Species Occur	Total No. of Quadrat Studied	Frequency %	Density	Abundance	Relative Frequency	Relative Density	Relative Dominance	IVI†	SDR††
I.	*PH*	12±(0.54)	06±(0.00)	10±(0.00)	60±(1.15)	1.2±(0.09)	2.0±(0.88)	21.42±(0.46)	19.04±(0.37)	33.43±(1.44)	73.89±(1.36)	24.63±(0.73)
	CP	13±(0.61)	07±(0.01)	10±(0.00)	70±(0.00)	1.3±(0.08)	1.8±(0.10)	25.00±(0.20)	20.63±(0.40)	13.37±(1.96)	59.00±(1.96)	19.66± (0.85)
	CO	32±(0.79)	09±(0.02)	10±(0.00)	90±(1.00)	3.2±(0.05)	3.5±(0.90)	32.14±(0.10)	50.79±(0.15)	44.61±(1.00)	127.54±(1.20)	42.51± (0.41)
	DS	03±(0.01)	03±(0.00)	10±(0.00)	30±(0.81)	0.3±(0.00)	1.0±(0.50)	10.71±(0.25)	4.76±(0.50)	5.59±(1.18)	21.06±(1.40)	7.02± (0.64)
II.	*PH*	13±(0.65)	06±(0.02)	10±(0.00)	60±(0.91)	1.3±(0.07)	2.1±(0.85)	18.18±(0.36)	14.60±(0.25)	18.54±(0.96)	51.32±(1.20)	17.10± (0.52)
	CO	48±(0.20)	10±(0.02)	10±(0.00)	100±(0.00)	4.8±(0.05)	4.8±(1.02)	30.30±(0.11)	53.93±(0.10)	47.52±(0.91)	131.75±(0.96)	43.91± (0.37)
	CP	07±(0.05)	06±(0.00)	10±(0.00)	60±(0.00)	0.7±(0.01)	1.1±(0.09)	18.18±(0.34)	7.86±(0.18)	6.96±(1.02)	33.00±(1.22)	11± (0.51)
	DS	05±(0.00)	04±(0.01)	10±(0.00)	40±(0.85)	0.5±(0.02)	1.2±(0.46)	12.12±(0.28)	5.61±(0.21)	5.71±(1.19)	23.44±(1.20)	7.81± (0.56)
III.	*PH*	70±(0.47)	10±(0.00)	10±(0.00)	100±(0.00)	7.0±(0.00)	7.0±(0.01)	31.25±(0.15)	53.84±(0.18)	46.10±(1.18)	131.19±(1.00)	43.73± (0.50)
	CO	46±(0.21)	08±(0.05)	10±(0.00)	80±(0.91)	4.6±(0.04)	5.7±(0.01)	25.00±(0.20)	35.38±(0.18)	44.66±(1.01)	105.04±(0.98)	35.01± (0.46)
	DS	03±(0.01)	03±(0.00)	10±(0.00)	30±(0.20)	0.3±(0.00)	1.0±(0.54)	9.37±(0.25)	2.30±(0.25)	3.24±(1.54)	14.91±(1.10)	4.97± (0.68)
	CP	03±(0.00)	03±(0.00)	10±(0.00)	30±(0.59)	0.3±(0.01)	1.0±(0.61)	9.37±(0.19)	2.30±(0.19)	1.45±(1.20)	13.12±(0.75)	4.37± (0.52)

All the values are mean of 10 replications.
Values within parentheses indicate± standard error of mean.
†Importance Value Index ; †† Sum- Dominance Ratio ; PH= Parthenium hysterophorus, CP= Calotropis procera, CO= Cassia occidentalis, DS= Datura stramonium

Table-2. Effect of shoot leachates of selected botanic agents on biochemical activity of *Parthenium hysterophorus* at 100% dose. The negative control group had distilled water. CD= critical difference at the 5% level of significance

Bio-agents	Concentration (%)	Shoot leachates		
		Chlorophyll (%)	Nitrogen(%)	Protein(%)
Control	-	30.52	6.39	39.93
Cassia occidentalis (BA1)	100	4.55	0.20	1.25
Calotropis procera (BA2)	100	10.67	1.15	7.18
Datura stramonium (BA3)	100	14.78	1.95	12.18

Fig-1. Graphical representation of biochemical analysis of bio-agents on *Parthenium hysterophorus*



RESULTS AND DISCUSSION

Of the total flora studied, different species exhibited different competitive abilities. Among all the weeds, *Cassia occidentalis* showed the strongest competitive ability against *Parthenium* (Table 1). Data recorded in Table 1 show that at Site III *Parthenium* was a dominant species having a number of 70 individual species, closely followed by *Cassia,* which was 46 in number. At Site I and II *Cassia occidentalis* was a dominant species having a value of 32 and 48 against *Parthenium,* which was only 12 and 13 in number. The highest sociability of *Parthenium* was observed at Site III and the relative frequency, relative density and relative dominance of *Parthenium* at Site III was found to be 31.25, 53.84 and 46.10, respectively followed by *Cassia* having sociability of 25.00, 35.38 and 44.66. Out of the three sites, two sites had *Cassia* as a dominant species with a maximum sociability of 30.30, 53.93 and 47.52 versus *Parthenium,* which had only 18.18, 14.60 and18.54 sociability at Site II. The highest SDR was recorded at Site II i.e. 43.91 of *Cassia occidentalis* against *Parthenium hysterophorus* which was only 17.10. Table-2. depicts maximum inhibition in chlorophyll by *C. occidentalis* i.e. 4.55 and was found to be significant, followed by *C. procera* in which 10.67 chlorophyll was observed. Minimum inhibition was observed in *D. stramonium* in which 14.78 chlorophyll was observed. Control received distilled water and was found to be 30.52. Maximum inhibition in nitrogen percentage was by shoot leachates of *C. occidentalis* i.e. 0.20 and was found to be significant followed by *C. procera* and *D.stramonium* in which 1.15 and 1.95 nitrogen percentage was observed. Protein content also depicts the same pattern with highest inhibition by *C. Occidentalis*(Fig.1). Some plants are already known to have potential in combating *Parthenium hysterophorus*. Anjum et al., (2005) concluded that an aqueous extract of Imperata cylindrica may restrict germination and seedling growth. The herbicidal potential of leaf leachates of plants such as *Cymbopogon citratus*, *Withania somnifera* and *Calotropis procera* have been assessed before; the effects of *C.citratus* were pronounced (Knox & Paul 2007). Foliar leachates of *Cassia* and then *Rumex* were the most effective in reducing levels of various leaf chemicals (Jaggi et al. 2008). Aqueous extracts of *Ocimum americanum* significantly inhibited the germination and seedling growth of *Parthenium* (Singh & Thaper 2002).

CONCLUSION

This study concluded that the 100%, 9th day aqueous shoot leachates of *Cassia occidentalis* have significant activity against *Parthenium hysterophorus* and offers an alternative tool for the control of this obnoxious weed thus proving the concept of allelopathic or biomolecular interactions amongst the plant species as a natural replacement method.

ACKNOWLEDGEMENT

The authors are grateful to the Principal, St. John's College, Agra for providing necessary facilities. The authors are also thankful to Mrs. Aradhna Knox for her English language assistance.

REFERENCES

Anjum T, Bajwa R, Javaid A (2005) Effect of *Imperata cylindrica* on distribution, germination and seedling growth of *Parthenium hysterophorus* L. *Fourth World Congress on Allelopathy* Aug, 2005, Charles Stuart University, Wagga, NSW, Australia.

Arnon DT (1949) Copper enzymes in isolated chloroplasts. Polyphenaloxidease in *Beta vulgaris*. *J Plant Physiology,* 24: 1-5.

Hanson HC Churchill ED (1961) *Th e Plant Community*. Reinhold Publishing Corporation, New York. pp.149-155.

Jaggi D, Knox J Paul MS (2008) Inhibitory effect of selected weeds on bioactivity of *Parthenium hysterophorus* (L.). National Seminar on traditional/indigenous practices for pest management of major crops 17-18 Nov, 2008, Allahabad Agricultural Institute-Deemed University, Allahabad.

Knox J Paul MS (2007) Population dynamics of *Parthenium hysterophorus* L. and its possible management through some competitive plants in India. 9th International Conference on the ecology & management of alien plant invasions, 17-21 Sept, 2007. Hyatt Regency, Perth, Western Australia.

Oosting HJ (1958) *Th e Study of Plant Communities*: Freeman WH & Corporation, San Francisco, New York.

Phillips EA (1959) *Methods of Vegetation Study*: Holt H & Corporation, New York.

Singh NB Thaper R (2002) Allelopathic effect of *Croton bonplandianum* on *Parthenium hysterophorus*. *Allelopathy Journal,* 10:163-170.

Snell FD Snell CT (1955) *Colorimetric methods of analysis of nitrogen*, Vol. 2, pp.813-816, A.D. van, Bostrand Company, Princeton, New Jersey.

Sukarwo P (1991) Vegetation analysis of aquatic weeds in Sentani lake, Irian Jaya. In: Lee, S.A. and K.F. Kon (eds), *Proc. 3rd Tropical Weed Sci. Conf.*, MAPPS, Kuala Lumpur, Malaysia, 539-545.